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(54) ELECTROMAGNETIC-WAVE-SHIELDING RESIN COMPOSITION AND MOLDING MADE THEREFROM

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a low-cost composition reduced in the content of a conductive filler and improved in moldability and molding appearance, by adding the conductive filler to the island phase of a sea-island structure resin composition having a specified or higher volume resistivity and comprising at least two thermoplastic resins.

SOLUTION: The resin composition having a volume resistivity of 1011Ωcm or above is used. The constituent thermoplastic resins are exemplified by polyethylene, polypropylene, polystyrene, polymethyl methacrylate, polyether sulfone and polyetherimide. The conductive filler is exemplified by carbon black, graphite, carbon fibers a metal powder or metal oxide fibers. It is desirable that a compatibilizer such as an epoxy-modified styrene/styrene copolymer is used. It is desirable that the thermoplastic resins constitute 10-80vol.% of the island phase in a two-component thermoplastic resin system and constitute 5-80vol.% of the

island phase in a three-component thermoplastic resin system.

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the electromagnetic wave cover nature resin composition which is the material corresponding to EMC (Electro-magnetic Compatibility). If it explains in full detail, in this invention, a telecommunication apparatus system, a device, etc. will cover the unnecessary electromagnetic waves emitted outside, or will cover the unnecessary electromagnetic waves which come from abroad, and will protect a telecommunication apparatus system, a device, etc.
Therefore, it is related with the electromagnetic wave cover nature resin composition which has the function to prevent malfunction of a telecommunication apparatus system, a device, etc., etc.

[0002]
[Description of the Prior Art]It was remarkable, multi-functionalization and digitization progressed quickly, and development of the telecommunication apparatus supporting a highly informative society has brought about rapid increase of LSI, increase of the amount of information, and improvement in the speed of the signal. As a result, various measures are worked on, in order for the adverse effect to the human body, etc. to pose a problem further and to solve these problems, malfunction of the apparatus by an electromagnetic interference wave, destruction, and.
[0003]The art which covers electromagnetic waves conventionally is examined as an example of measures, and the conductive resin composition which gave conductivity to the polymer material is proposed as a charge of an electromagnetic wave shielding material used for this. The above-mentioned conductive resin composition to a polymer material A metal fiber, a metal powder, carbon fiber, Conductive fillers, such as carbon powder, are kneaded and

composite-ized, or a conductive fiber is completed, and it is manufactured by making into a conductive filler the conductive resin composition etc. which covered **** plasticity resin on the surface, and composite-izing them.

[0004]Especially, the high conductive filler of aspect ratios, such as fibrous and the shape of a scale, and a conductive filler with big particle diameter tend to be blended so much, and tend to be composite-ized, and it is going to obtain high conductivity by aiming at the flow of a resin composition. Here, the aspect ratio expresses the ratio of the length of a major axis direction to minor-axis lay length in the shape of a filler.

[0005]Many high concentration or methods of composite-izing with high density or uniformly are also proposed in the resin matrix in the above conductive fillers in order to obtain the conductive resin composition of high conductivity.

[0006]However, according to these methods, although surely the conductivity of a resin composition improves, the appearance of the cast obtained since the molding workability falls, and the shape of the mold goods obtained as a result and a use are limited and also molding workability falls worsens simultaneously. For this reason, when these casts are built into the outside surface of a product, secondary elaboration, such as surface coating, is required and this is complicated.

[0007]Many methods of reducing the loadings of the conductive filler in a resin matrix are also proposed in order to improve the molding workability of a conductive resin composition. Especially JP,62-4749,A, JP,1-263156,A, JP,2-113068,A, etc., The multicomponent system thermoplastics of imperfect compatibility is mutually used as a matrix, JP,61-29470,A uses as a matrix the multicomponent system thermoplastics in which mobility and melting mobility differ from melting temperature mutually, And in composite-izing which uses the morphology that the resin matrix forms sea-island structure, and blends a conductive filler, By making a conductive filler unevenly distributed in the continuous phase by the side of the sea in this sea-island structure, the conductivity of a continuous phase is improved, and the conductivity as the whole resin composition is improved, and it is indicating reducing the loadings of a conductive filler.

[0008]JP,50-32240,A, JP,63-207855,A, etc., In this multicomponent system thermoplastics in which it comprises multicomponent system thermoplastics and a conductive filler, this multicomponent system thermoplastics forms the three-dimensional network structure, and this conductive filler forms the three-dimensional network structure, By making it unevenly distributed in a specific resinous principle, make an efficient continuity path form and in the amount of conductive fillers equivalent to the former. The art of obtaining the resin composition which is equivalent to the former or has the high conductivity beyond it in the small amount of conductive fillers rather than obtaining a conductive high resin composition more or the former is indicated.

[0009]However, the art about such a conventional electromagnetic wave cover nature resin composition, Since a conductive filler is blended with resin, the conductivity of a resin composition is raised and this gives electromagnetic wave shielding performance, there is a limit naturally to such an extent that the amount of conductive fillers blended into a resin matrix is reduced.
[0010]Therefore, the conductive resin composition require that the loadings of a conductive filler are still abundant, and according to the above-mentioned conventional technology for this reason, For an essential improvement, it does not put on very much about molding workability or appearance defect nature, but the electromagnetic wave shielding performance of the electromagnetic wave cover nature resin composition by the above conductive resin compositions is still insufficient, or its molding workability etc. are insufficient, and there are many problems practically.
[0011]On the other hand, JP,8-64986,A, JP,8-67544,A, JP,8-83992,A, JP,8-105188,A, JP,8-111594,A, etc., By blending and composite-izing carbon fiber, ferrite powder, etc. in the matrix of resin, cement, a lightweight aggregate, etc., Or if the composite-ized material is incorporated in layers in an above-mentioned matrix and electromagnetic waves hit this, the so-called wave absorber using dielectric loss or a magnetic loss arising will be proposed.
[0012]However, these wave absorbers are combined with a metal plate, a ferrite tile, etc., and are fabricated to a pyramid type, and are used as building materials.
It cannot use for cases, such as telecommunication apparatus of which surface smoothness or molding workability is required, and a device at all.

[0013]Therefore, as explained above, the electromagnetic wave cover nature resin composition which has simultaneously sufficient electromagnetic wave shielding performance and the outstanding molding workability which can manufacture the precision mold goods of which advanced surface smoothness is required is not proposed until now.
[0014]For this reason, the actual condition of electromagnetic wave cover [need / telecommunication apparatus etc. / to be electromagnetic wave covered] of a product part is depending for that product part on performing metallizing processings (plating of metal, vacuum evaporation, thermal spraying, spreading of a conductive paint, etc.) to the wrap resin composition surface.
According to this processing, electromagnetic wave cover nature comes out enough, there is a problem in the workability of a certain thing, and there is a problem in physical, the chemical stability of the processing part of a product, etc. which were acquired further.
Since the metallizing processing to the resin composition surface itself is-like secondary processing, if the running cost, material cost, etc. are included, it will become what has the very high rate that the cost which the electromagnetic wave cover in a product price takes

occupies.

[0015]

[Problem(s) to be Solved by the Invention]The place which this invention persons are going to solve many above-mentioned problems, and is made into the purpose, [in the case of mold-goods processing can reduce the loadings of the conductive filler which constitutes an electromagnetic wave cover nature resin composition, and using this resin composition in the case of this resin composition manufacture], There is also no generating of a poor flow of this resin composition, a crack, surface unevenness, camber, etc., the cast which excelled [molding working condition / usual] in precision and appearance can be obtained, and it is in providing the insulating electromagnetic wave cover nature resin composition which moreover has sufficient electromagnetic wave shielding performance, and the mold goods using this.

[0016]

[Means for Solving the Problem]This invention persons about art which composite-izes thermoplastics and a conductive filler. As a result of inquiring wholeheartedly that a fault in molding workability should be solved, by making a multicomponent system thermoplastics matrix distribute a conductive filler unevenly, By this multicomponent system thermoplastics matrix's forming sea-island structure which consists of a continuous phase and a discontinuous phase, if it explains in full detail, and making this conductive filler unevenly distributed to a discontinuous phase by the side of an island in this sea-island structure, It finds out that an electromagnetic wave cover nature resin composition which could reduce loadings of this conductive filler and has improved faults, such as difficult molding workability which was a problem conventionally, an appearance defect, and a high cost, is obtained, and came to complete this invention.

[0017]Namely, in an electromagnetic wave cover nature resin composition in which this invention contains at least two sorts of thermoplastics, and a conductive filler as the main ingredients, Have the sea-island structure which said resin composition has a value of volume resistivity more than 10^{11}omegacm, and said resin composition constituted from said at least two sorts of thermoplastics, and. An electromagnetic wave cover nature resin composition making said conductive filler come to be unevenly distributed in said discontinuous phase is proposed.

[0018]In an electromagnetic wave cover nature resin composition in which this invention contains at least two sorts of thermoplastics, a conductive filler, and a compatibilizer as the main ingredients, Have the sea-island structure which said resin composition has a value of volume resistivity more than 10^{11}omegacm, and said resin composition constituted from said at least two sorts of thermoplastics, and. An electromagnetic wave cover nature resin composition making said conductive filler come to be unevenly distributed in said discontinuous phase is proposed.

[0019]This invention proposes a cast which carries out the fabricating operation of the above-mentioned electromagnetic wave cover nature resin composition.

[0020]

[Embodiment of the Invention]By ** which controls the dispersibility of the conductive filler in a multicomponent system thermoplastics matrix, the resin composition of this invention improves electromagnetic wave shielding performance remarkably, and it demonstrates good molding workability. When lessons is taken from this point and it explains in full detail further, the electromagnetic wave shielding performance of the resin composition of this invention, Form the conductive site maldistribution-ized as a discontinuous phase into this resin composition, and it absorbs with reflection of the electromagnetic waves by this, And the electromagnetic waves by the dielectric loss of this resin composition or magnetic loss are made to absorb, electromagnetic waves are covered, and the conventional proposal of the electromagnetic wave cover nature resin composition based on such a concept is not made in the limitation which this invention persons get to know.

[0021]The value of the volume resistivity of the resin composition of this invention is more than 10^{11}omegacm, and although the upper limit should just be an equal mostly at the value of resin composition ingredient independent volume resistivity, generally it is 10^{13} - 10^{18}omegacm. It spreads that this is an insulating field, therefore the use is insulation also in the product part demanded. Namely, substitution of the resin composition etc. which are used for a part to which precision shaping also accompanies by it or follows metallizing on the conductive resin composition used as a case for electromagnetic wave cover, etc. from the former or the above surfaces depending on the case is possible for this invention resin composition.

[0022]Since this invention resin composition does not conduct the electrical and electric equipment with insulation, it is not necessary to classify a conductive site and an insulating part. Therefore, without incorporating individually also to the part where electromagnetic wave cover nature is demanded, and the part where both of a part of whom insulation is required exist, the integrally molded product by the material of this invention can be incorporated, and there is an advantage to which manufacture, maintenance, etc. become easy.

[0023]Although the shielding effect of the conventional conductive resin composition has a general case where the value of 20-60 dB is shown, the value of the shielding effect as the conventional resin composition in which the electromagnetic wave cover nature resin composition of this invention is also almost the same is shown.

[0024]Hereafter, this invention is explained in detail.

[0025]The thermoplastics used by this invention Polyethylene (PE), polypropylene (PP), Polystyrene (PS), polymethylmethacrylate (PMMA), an acrylonitrile butadiene styrene (ABS)

copolymer, Polyacetal (POM), polycarbonate (PC), polyphenylene ether (PPE), Modified polyphenylene ether (m-PPE), polyamide (PA: nylon), Polyethylene terephthalate (PET), polybutylene terephthalate (PBT), A polyphenylene sulfide (PPS), polyether sulphone (PES), Sea-island structure is formed, when two or more sorts of things chosen from polyether imides (PEI) are preferred, and these resin is combined or these resin and conductive fillers are combined.

[0026]Various additive agents may be suitably blended with the thermoplastics used by this invention for the purpose, such as the fundamental performance of resin, for example, a mechanical property, an electrical property, heat resistance, molding workability, mobility or melting mobility, fire retardancy, ultraviolet resistance, chemical resistance or coloring, and gloss grant.

[0027]As an example of a concrete additive agent, antioxidants, such as a plasticizer, a thermostabilizer, a phenol system, or sulfur systems, stabilizer, a cross linking agent, a flameproofing agent, an ultraviolet ray absorbent, a neutralizer, lubricant, colorant, a gloss grant agent, etc. are mentioned.

[0028]In this invention, the multicomponent system resin in which the conductive filler mentioned later is made unevenly distributed is multicomponent system thermoplastics which consists of two or more sorts of said thermoplastics.

[0029]As an example of the combination of the desirable thermoplastic resin component as two-component system thermoplastics, m-PPE/PE, m-PPE/PP, m-PPE/PMMA, m-PPE/POM, PC/PS, PC/PE, PC/PP, PC/ABS, PC/PMMA, PC/POM, m-PPE/PEI, m-PPE/PBT, m-PPE/PC, m-PPE/PES, m-PPE/LCP, PEI/PBT, PEI/PC, PEI/PES, PEI/LCP, PBT/PES, PC/PES, PC/LCP, PES/LCP, m-PPE/PA, m-PPE/PET, m-PPE/PPS, PEI/PET, etc. are mentioned.

[0030]When the whole quantity of two-component system thermoplastics is made into 100 capacity % as the compounding ratio, more than 10 capacity % has a preferred resinous principle in which you are going to make it form the discontinuous phase by the side of the island in the sea-island structure of this two-component system thermoplastics, and it is more than 20 capacity % more preferably.

[0031]If less than 10 capacity %, it becomes difficult to distribute the conductive filler of the desired quantity mentioned later, and the resin composition which has simultaneously electromagnetic wave cover nature and the outstanding molding workability may not be obtained.

[0032]As an example of the combination of the desirable thermoplastic resin component as 3 component-system thermoplastics, m-PPE/PE/PC, m-PPE/PP/PC, m-PPE/PMMA/PC, m-PPE/POM/PC, PC/PS/PMMA, PC/PE/PMMA, PC/PP/PMMA, PC/ABS/PMMA, PC/POM/PMMA, m-PPE/PEI/LCP, m-PPE/PBT/LCP, m-PPE/PC/LCP, m-PPE/PES/LCP, PEI/PBT/LCP, PEI/PC/LCP, PEI/PES/LCP, PBT/PES/LCP, PC/PES/LCP, m-PPE/PEI/PBT, m-

PPE/PBT/PC, m-PPE/PC/PES, PEI/PBT/PC, PBT/PC/PES, etc. are mentioned.

[0033]As the compounding ratio, when the whole quantity of 3 component-system thermoplastics is made into 100 capacity %, more than 5 capacity % has a preferred resinous principle in which you are going to make it form the discontinuous phase by the side of the island in the sea-island structure of this 3 component-system thermoplastics, and it is more than 10 capacity % more preferably.

[0034]If less than 5 capacity %, the resin composition which has simultaneously electromagnetic wave cover nature and the outstanding molding workability for the same reason as the case of above-mentioned two-component system thermoplastics may not be obtained.

[0035]The loadings of the resinous principle in which you are going to make it form the discontinuous phase by the side of the island in the sea-island structure of the resin composition of this invention of below 75 capacity % are [below 80 capacity %] below 50 capacity % more preferably to the resinous principle whole quantity.

[0036]When more than 80 capacity %, even if the discontinuous phase in sea-island structure is not formed or it forms a discontinuous phase, When a discontinuous phase approaches or contacts mutually, it may become a continuous phase substantially, the discontinuous phase in sea-island structure may form a continuous phase as the whole resin, and the value of volume resistivity may become smaller than 10^{11}omegacm as the whole resin composition.

[0037]Also in the multicomponent system resin composition of four or more component systems, the same view as the above can be applied and these are also included by this invention.

[0038]In the resin composition of this invention, various common compatibilizers may be added in the range in which electrical properties, such as electromagnetic wave cover nature, are not reduced.

[0039]As an example of a compatibilizer, an epoxy denaturation styrene styrene copolymer, An epoxy denaturation styrene-methylmethacrylate copolymer, an epoxy denaturation methyl methacrylate styrene ethylenic copolymer, An epoxy denaturation methyl methacrylate methyl methacrylate ethylenic copolymer, A styrene-methylmethacrylate copolymer, an epoxy denaturation methyl methacrylate methyl methacrylate copolymer, an epoxy denaturation methyl methacrylate styrene copolymer, a maleic anhydride-vinyl system copolymer, etc. are mentioned.

[0040]However, the copolymer said here refers to a random copolymer, a block copolymer, an alternating copolymer, a graft copolymer, etc. As a vinyl monomer, styrene, ethylene, propylene, VCM/PVC, vinyl acetate, methyl acrylate, methyl methacrylate, the methyl vinyl ether, ethyl vinyl ether, propylvinyl ether, etc. are mentioned.

[0041]Generally, the dispersibility of the resin composition by a polymer alloy of the constituent

of the multicomponent system thermoplastics which includes a conductive filler by adding a compatibilizer improves, and molding workability, a mechanical strength, heat resistance, etc. are improved.

[0042]When adding a compatibilizer to the resin composition of this invention, the loadings can be arbitrarily chosen in the range to which electrical properties, such as electromagnetic wave cover nature, do not fall, but if too small, the above effects are not acquired and the loadings more than needed are disadvantageous in economical efficiency.

[0043]Therefore, when the resin composition whole quantity is made into 100 weight sections, 0.01 to 20 weight section is preferred, and it is especially more preferred that it is 0.1 to 10 weight section.

[0044]The conductive filler which has publicly known conductivity can be used for the conductive filler used in this invention.

[0045]As an example of a conductive filler, the oil furnace method, the gas furnace method, The carbon black manufactured by each process, such as a channel process and thermal **, The acetylene black which used acetylene as the raw material, natural graphite, the artificial graphite which processes amorphous carbon at not less than about 2000 ** elevated temperature, and is manufactured, The carbon fiber produced by processing this at the temperature of not less than about 800 ** by using as a raw material the pitch textiles etc. which carried out melt spinning of an acrylic synthetic fiber (PAN textiles), a cellulosic fiber (rayon) or a petroleum pitch, or the coal pitch, Carbon system fillers, such as a graphite fiber produced by processing this at not less than about 2000 ** elevated temperature, Metal system conductive fillers, such as gold, silver, copper, iron, platinum, steel, aluminum, and palladium, The electric conduction covering form filler etc. which carried out the coat of the surface of metallic-oxide system conductive fillers, such as a zinc oxide, tin oxide, indium oxide, and titanium oxide, and various inorganic fillers for the above conductive raw materials are mentioned.

[0046]Powder, a globular shape, or an aspect ratio the shape of the conductive filler used for this invention Ten or less. It is five or less staple fiber preferably, and that mean particle diameter or whose mean fiber diameter is 0.001-100 micrometers is preferred, is 0.001-10 micrometers more preferably, and is 0.01-1 micrometer especially preferably.

[0047]When an aspect ratio is larger than 10, or when mean particle diameter is larger than 100 micrometers, maldistribution-ized distribution of the conductive filler to said multicomponent system thermoplastics matrix not only becomes difficult, but it may spoil the molding workability of a constituent, the appearance of mold goods, etc.

[0048]When mean particle diameter is smaller than 0.001 micrometer, under the present circumstances, it is difficult to obtain such a conductive filler industrially, and since there is a problem in economical efficiency and also relative bulk density becomes low, it may become

difficult composite-ization of the desired quantity to thermoplastics and to handle it.
[0049]What it is a set of particles without the shape where the conductive filler became settled that conductive filler shape is powdered, and suits the above-mentioned conditions is said.
[0050]As for the loadings of a conductive filler, it is preferred to consider it as 1 - 50 capacity % to the sum total capacity of thermoplastics and this conductive filler, they are two to 35 capacity % more preferably, and it is preferred to consider it as 2 - 20 capacity % especially.
[0051]When combination of this conductive filler is less than 1 capacity %, sufficient electromagnetic wave cover nature cannot be obtained.
[0052]In the sea-island structure of the multicomponent system thermoplastics containing this conductive filler in the resin composition which manufacture of a resin composition becomes difficult or is obtained when exceeding 50 capacity %, It may become difficult to make this conductive filler unevenly distributed to the discontinuous phase by the side of an island, and the value of the volume resistivity of the molding workability of this resin composition not only worsening but this resin composition may become lower than 10^{11}omegacm.
[0053]Other inorganic fillers or organic fillers may be used together within limits to which physical properties, such as molding workability, are not reduced. As an example of an usable inorganic filler, calcium carbonate, talc, mica, Glass, magnesium hydroxide, aluminium hydroxide, barium sulfate, Molybdenum disulfide, alumina, silica, boron, zirconia, and Fe-aluminum alloy, To Sendust of Fe-Si alloy and a Fe-Si-aluminum alloy, nickel-Fe alloy, or this, Mo, the permalloy of the plural system alloy which added Cu, Cr, etc., and general formula $MO\text{-}Fe_2O_3$ -- a group with a presentation -- wood flour etc. are mentioned as organic fillers, such as a ferrite (M is divalent metal ions, such as Ba, Sr, Pb, Mn, Fe, Co, nickel, and Zn) which is iron oxide.
[0054]By adding these inorganic fillers or an organic filler, molding workability, a mechanical strength, heat resistance, etc. are improved.
[0055]in this invention -- the above -- even if small, the sea-island structure by at least two sorts of thermoplastics is formed by composite-izing two kinds of thermoplastics, and a conductive filler by the method shown below, and the blended conductive filler is unevenly distributed in a discontinuous phase.
[0056]The value of capacity % of the conductive filler in the resin composition of a discontinuous phase the grade to which a conductive filler is unevenly distributed in a discontinuous phase, It is desirable for not less than at least 50% of the conductive fillers which should just exist more greatly than the value of capacity % of the conductive filler in the resin composition of a sea phase, and were blended preferably to contain in the discontinuous phase, and it is more preferred that 70 to 100% contains in the discontinuous phase especially.

[0057]The method of evaluating the distribution state in the molecular level of the element

which contains the distribution state of the resinous principle in a resin composition or the ingredient of a conductive filler in more detail as a valuation method which is a grade in which the conductive filler mentioned above is unevenly distributed is mentioned.

[0058]Specifically, the information about the kind and distribution state (sea-island structure) of a constituent can be acquired with a scanning electron microscope (SEM) or a scanning type probe electron microscope (SPM). The information about the distribution state of each element which constitutes a resin composition can be acquired with an X-ray microanalyser (XMA) or an electron probe microanalyzer (EPMA) in detail.

[0059]It can evaluate by counting the number of particles, observing with the naked eye or taking the size of conductive filler particles into consideration based on the information acquired with such analytical method, using the image processing system for particle analysis.

[0060]Although the electromagnetic wave cover nature resin composition of this invention can be manufactured with various kinds of manufacturing methods, being based on the method of illustrating next is preferred.

(1) How to composite-ize different thermoplastics of a kind which obtains the resin composition which composite-ized the conductive filler to thermoplastics as the 1st step and with which this resin composition and this resin composition are not presented as the 2nd step after that.

(2) How to perform the 1st step and 2nd-step above-mentioned composite-ization in the same system in one step.

[0061]In the below-mentioned general manufacturing installation (one set of for example, a biaxial extruding kneading machine), the same system is a case where it is carried out from the same material input mouth here, when the 1st step and 2nd-step above-mentioned composite-ization is performed from a different material input mouth.

[0062]The resin composition of this invention can be manufactured using general composite material production technology. Manufacturing by a melt kneading method industrially is preferred in respect of productivity and economical efficiency.

[0063]Specifically, manufacture by continuation kneading using a biaxial extrusion machine or a single screw extruder and manufacture by the heat melting kneading machine of the batch type represented by the lab PURASUTO mill are mentioned.

[0064]Since the resin composition of this invention is thermoplasticity, fabricating operations, such as injection molding, extrusion molding, and press forming, are possible for it.

[0065]The resin composition of this invention is an electromagnetic wave cover nature resin composition which was obtained by composition which was illustrated above, and a manufacturing method, and solved faults, such as the difficulty of a fabricating operation which was a problem, an appearance defect of a fabricating-operation article, and a high cost, in the conventional electromagnetic wave cover nature resin composition and which has specific morphology.

[0066]Hereafter, this invention is not limited by these although an example and a comparative example explain this invention concretely.
[0067]As for the thermoplastics of a raw material, and the thermoplastic resin composition obtained by the 1st-step composite-ization with which the 2nd-step above-mentioned composite-ization is presented, it is preferred to perform predrying in advance of supply to kneading apparatus, such as a biaxial extrusion machine, for water removal.
[0068]
[Example]The thermoplastics used in the following examples and a comparative example and a conductive filler are as being shown below.
[0069]<Use thermoplastics> and PPE: Modified polyphenylene ether Asahi Chemical Industry Co., Ltd. make Trade name "xyron 100V"

Specific-gravity [of 1.07g/cm] (ASTM D 792) ^{3}, and PEI: Polyether imide Product made from Japanese GE Plastics Trade name "Ultem 1000"

Specific-gravity [of 1.27g/cm] (ASTM D 792) ^{3}, and PBT: Polybutylene terephthalate Polyplastics make Trade name "Jura NEKKUSU 2072"

Specific gravity (ASTM D 792) 1.41 g/cm^{3} and PC : Polycarbonate Made in Teijin Chemicals Trade name "pan light L1250", Number-average-molecular-weight 25000 specific-gravity (ASTM D 792) 1.20 g/cm^{3} and PES: Polyether sulphone Sumitomo Chemical Co., Ltd. make Trade name "SUMIKA Excel 3600G", The number average molecular weight 56000 - 57000 specific-gravity (ASTM D 792) 1.37 g/cm^{3} and LCP: Liquid crystal polyester Unitika, Ltd. make Trade name "rod run LC-5000."

[0070]Specific gravity (ASTM D 792) 1.41g/cm^{3}.
[0071]A <use conductive filler> and carbon black mean particle diameter of 0.03 micrometer, - metal system (silver) conductive filler mean particle diameter of 0.4 micrometer written as below spherical and CB, Spherical Powdered [- metal system (iron) conductive filler mean particle diameter of 45 micrometers hereafter written as AG] - electric conduction covering form conductive filler hereafter written as FH (what used barium sulfate as the core and covered the tin oxide system conductive layer on the surface)
Spherical [mean particle diameter of 0.4 micrometer] - conductivity carbon fiber mean fiber diameter hereafter written as BS 0.8 micrometer, fibrous, aspect ratio It is written as 8 or less and CS.
[0072]<Use compatibilizer> and epoxy denaturation styrene (St)-St Copolymer Toagosei Chemical industry Trade name "RESEDA GP-500"
- epoxy denaturation St-methyl methacrylate (MMA) Copolymer Toagosei Chemical industry written as ESS below A trade name ". [- epoxy denaturation MMA-St-ethylene (Et) copolymer Nippon Oil & Fats which writes it as less than RESEDA GP-300ESM] Trade name "Modiper A-

4100"

The -St-maleic anhydride copolymer MTC Arco trade name outlined the following EMSE "DYLARK 232"

The - epoxy denaturation MMA-MMA-Et copolymer Nippon Oil & Fats Co., Ltd. trade name outlined the following SMa "Modiper A-4200"

The -St-MMA Copolymer Toagosei Chemical industry trade name outlined the following EMME "it is written as or less [RESEDA GP-] 200SM.

[0073]The presentation of each resin composition in Examples 1-67 and the comparative examples 1-5 is shown in Table 1.

[0074]

[Table 1]

表1

実施例	熱可塑性樹脂（種類/重量部）		導電性フィラー（種類/重量部）	相容化剤（種類/重量部）
	A	B	C a	b
実施例1	PPE/26.4	PEI/70.0	CB/3.6	
実施例2	PEI/26.4	PPE/70.0	CB/3.6	
実施例3	PPE/16.0	PEI/60.0	AG/24.0	
実施例4	PEI/16.0	PPE/60.0	AG/24.0	
実施例5	PPE/20.0	PEI/50.0	BS/30.0	
実施例6	PEI/20.0	PPE/50.0	BS/30.0	
実施例7	PPE/25.2	PEI/70.0	CS/4.8	
実施例8	PEI/25.2	PPE/70.0	CS/4.8	
実施例9	PPE/20.0	PEI/50.0	FH/30.0	
実施例10	PEI/20.0	PPE/50.0	FH/30.0	
実施例11	PPE/26.4	PC/70.0	CB/3.6	
実施例12	PC/27.6	PPE/70.0	CB/2.4	
実施例13	PPE/16.0	PC/60.0	AG/24.0	
実施例14	PC/16.0	PPE/60.0	AG/24.0	
実施例15	PPE/20.0	PC/50.0	BS/30.0	
実施例16	PC/20.0	PPE/50.0	BS/30.0	
実施例17	PPE/25.2	PC/70.0	CS/4.8	
実施例18	PC/25.2	PPE/70.0	CS/4.8	
実施例19	PPE/20.0	PC/50.0	FH/30.0	
実施例20	PC/20.0	PPE/50.0	FH/30.0	

[0075]

[Table 2]

（表１の続き）

実施例21	PPE/26.4	PBT/70.0	CB/3.6
実施例22	PBT/26.4	PPE/70.0	CB/3.6
実施例23	PPE/26.4	PES/70.0	CB/3.6
実施例24	PES/26.4	PPE/70.0	CB/3.6
実施例25	PEI/26.4	PC/70.0	CB/3.6
実施例26	PC/26.4	PEI/70.0	CB/3.6
実施例27	PEI/16.0	PC/60.0	AG/24.0
実施例28	PC/16.0	PEI/60.0	AG/24.0
実施例29	PEI/20.0	PC/50.0	BS/30.0
実施例30	PC/20.0	PEI/50.0	BS/30.0
実施例31	PEI/25.2	PC/70.0	CS/4.8
実施例32	PC/25.2	PEI/70.0	CS/4.8
実施例33	PEI/20.0	PC/50.0	FH/30.0
実施例34	PC/20.0	PEI/ 50.0	FH/30.0
実施例35	PEI/26.4	PBT/70.0	CB/3.6
実施例36	PBT/26.4	PEI/70.0	CB/3.6
実施例37	PEI/26.4	PES/70.0	CB/3.6
実施例38	PES/26.4	PEI/70.0	CB/3.6
実施例39	PC/26.4	PES/70.0	CB/3.6
実施例40	PES/26.4	PC/70.0	CB/3.6

[0076]
[Table 3]

（表１の続き）

実施例41	PBT/26.4	PES/70.0		CB/3.6	
実施例42	PES/26.4	PBT/70.0		CB/3.6	
実施例43	PPE/44.0	PEI/50.0		CB/6.0	ESS/1.0
実施例44	PPE/61.6	PEI/30.0		CB/8.4	ESS/5.0
実施例45	PPE/28.0	PEI/30.0		AG/42.0	ESS/5.0
実施例46	PPE/44.0	PC/50.0		CB/6.0	ESM/5.0
実施例47	PC/46.0	PPE/50.0		CB/4.0	ESM/1.0
実施例48	PC/28.0	PPE/30.0		AG/42.0	ESM/1.0
実施例49	PES/44.0	PPE/50.0		CB/6.0	EMSE/1.0
実施例50	PES/61.6	PPE/30.0		CB/8.4	EMSE/5.0
実施例51	PEI/44.0	PC/50.0		CB/6.0	EMME/1.0
実施例52	PEI/61.6	PC/30.0		CB/8.4	SMa/5.0
実施例53	PC/28.0	PEI/30.0		AG/42.0	SMa/1.0
実施例54	PES/44.0	PEI/50.0		CB/6.0	SM/1.0
実施例55	PPE/26.4	PEI/50.0	LCP/20.0	CB/3.6	
実施例56	PPE/26.4	PEI/50.0	PBT/20.0	CB/3.6	
実施例57	PPE/26.4	PC/50.0	LCP/20.0	CB/3.6	
実施例58	PPE/26.4	PES/50.0	LCP/20.0	CB/3.6	
実施例59	PPE/26.4	PES/50.0	PBT/20.0	CB/3.6	
実施例60	PC/26.4	PEI/35.0	LCP/20.0	CB/3.6	

[0077]

[Table 4]

（表１の続き）

実施例61	PC/26.4	PEI/35.0	PPE/35.0	CB/3.6	
実施例62	PEI/26.4	PES/50.0	LCP/20.0	CB/3.6	
実施例63	PEI/26.4	PES/50.0	PBT/20.0	CB/3.6	
実施例64	PEI/26.4	PES/35.0	PPE/35.5	CB/3.6	
実施例65	PC/26.4	PES/50.0	LCP/20.0	CB/3.6	
実施例66	PC/26.4	PES/50.0	PBT/20.0	CB/3.6	
実施例67	PC/26.4	PES/35.0	PPE/35.0	CB/3.6	
比較例1	PPE/88.0			CB/12.0	
比較例2	PEI/88.0			CB/12.0	
比較例3	PC/88.0			CB/12.0	
比較例4	PBT/88.0			CB/12.0	
比較例5	PES/88.0			CB/12.0	

The thermoplastics A and conductive filler a which are shown in the one to example 42 table 1

by predetermined composition ratio. Using the biaxial extruding kneading machine (product "ZEmade by bell SUTORUFU40A; the screw diameter of 43 mm, screw major-axis ratio 33.5"), heat melting kneading was carried out, and after water cooling or air cooling, the pelletizer cut the strand and it pelletized. (Composite-izing the 1st step)
then, composite-izing -- the kneading resin obtained in the 1st step, and the thermoplastics B. PURIBURENDO [predetermined composition ratio] -- this PURIBURENDO preparation -- composite-izing -- like the 1st step, heat melting kneading was carried out, and after water cooling or air cooling, the pelletizer cut the strand, it pelletized, and the resin composition of this invention was obtained. (Composite-izing the 2nd step)
Selection of the operating condition of an extrusion machine etc. was suitably performed in accordance with the conventional method.
[0078]the thermoplastics A and conductive filler a which are shown in the 43 to example 54 table 1 -- predetermined composition ratio -- composite-izing of Examples 1-42 -- it pelletized by the same method as the 1st step. (Composite-izing the 1st step) composite[after that and]-izing -- the thermoplastics B was added to the kneading resin obtained in the 1st step, the compatibilizer was added by predetermined composition ratio to it on the basis of all the thermoplastics to constitute, and the resin composition of this invention was obtained to it.
[0079]the thermoplastics A and conductive filler a which are shown in the 55 to example 67 table 1 -- predetermined composition ratio -- composite-izing of Examples 1-42 -- it pelletized by the same method as the 1st step. (Composite-izing the 1st step)
then, composite-izing -- the kneading resin obtained in the 1st step, and the thermoplastics B and the thermoplastics C. PURIBURENDO [predetermined composition ratio] -- composite-izing -- like the 1st step, heat melting kneading was carried out, and after water cooling or air cooling, the pelletizer cut the strand, it pelletized, and the resin composition of this invention was obtained (composite-izing the 2nd step).
[0080]the thermoplastics A and conductive filler a which are shown in the one to comparative example 5 table 1 -- predetermined composition ratio -- composite-izing of Examples 1-42 -- it pelletized by the same method as the 1st step, and kneading resin was obtained.
[0081]then, composite-izing -- PURIBURENDO [the kneading resin obtained in the 1st step, and the thermoplastics B / predetermined composition ratio] -- this PURIBURENDO preparation -- composite-izing -- like the 1st step, heat melting kneading was carried out, and after water cooling or air cooling, the pelletizer cut the strand and it pelletized. About what has difficult strand-izing, the strand fragment was ground and kneading resin was obtained. (Composite-izing the 2nd step)
The evaluation result of this invention article obtained by Examples 1-67 and the comparative examples 1-5 and a comparison article is shown in Table 2. E shows an index among Table 2, for example, ten E15 shows 10^{15}.

[0082]<Shielding effect valuation method> Predrying was performed to this invention article and comparison article which were obtained for water removal, and the 150mmx150mmx5mm plate-like specimen was created using the injection molding machine or the press-forming machine.
[0083]About this specimen, the extinction ratio (shielding effect) of the field intensity in a contiguity community was measured using the electromagnetic shielding material assessment system by ADVANTEST CORP.
[0084]Although various methods of evaluating the electromagnetic wave shielding performance of material are proposed, the value of what is called a shielding effect (SE) which evaluates the attenuation grade of an artificial radiated electromagnetic wave is widely used as an index.
[0085]<Volume resistivity valuation method> Predrying was performed to this invention article and comparison article which were obtained for water removal, and the phi100mmx1.6mm disc-like specimen or the 150mmx130mmx5mm plate-like specimen was created using the injection molding machine or the press-forming machine.
[0086]About this specimen, volume resistivity was measured using the ADVANTEST CORP. make digital ultra high resistance / very small ammeter, or the multimeter based on JIS K6911.

[0087]In manufacture of the culmination according to the biaxial extruding kneading machine of > resin composition about evaluation of < moldability, A possible thing O, [obtaining a fixed quantity of pellets in which the input from a feeder is good at 50 or more kg/h, or] **, pelletizing, or strand-ization made the difficult thing x for what has possible obtaining O and a pellet good at 20 or more kg/h for what has possible obtaining a good pellet by 30 or more kg/h.
[0088]What O, what [an irregular color is slightly regarded as] **, unevenness, camber, etc. are regarded as about the specimen for <formed-product-appearance evaluation> volume resistivity evaluation in what unevenness, camber, an irregular color, etc. are not regarded as on the surface was made into x.
[0089]
[Table 5]

表２

	シールド効果［dB］	体積抵抗率［Ωcm］	成形性	成型品外観
実施例1	35	10E16	◎	○
実施例2	34	10E16	◎	○
実施例3	31	10E16	◎	○
実施例4	30	10E15	◎	○
実施例5	30	10E15	◎	○
実施例6	28	10E16	◎	○
実施例7	29	10E15	◎	○
実施例8	28	10E15	◎	○
実施例9	30	10E16	○	○
実施例10	30	10E16	○	○
実施例11	37	10E15	◎	○
実施例12	31	10E15	◎	○
実施例13	33	10E15	◎	○
実施例14	36	10E16	○	○
実施例15	30	10E16	◎	○
実施例16	32	10E16	◎	○
実施例17	30	10E14	◎	○
実施例18	31	10E15	◎	○
実施例19	31	10E16	○	○
実施例20	32	10E16	○	○

[0090]

[Table 6]

（表２の続き）

実施例21	30	10E14	◎	○
実施例22	28	10E15	○	○
実施例23	34	10E15	◎	○
実施例24	31	10E16	○	○
実施例25	33	10E15	◎	○
実施例26	35	10E15	◎	○
実施例27	29	10E16	◎	○
実施例28	31	10E15	◎	○
実施例29	29	10E16	◎	○
実施例30	32	10E16	◎	○
実施例31	29	10E15	◎	○
実施例32	29	10E15	◎	○
実施例33	30	10E15	◎	○
実施例34	33	10E16	◎	○
実施例35	27	10E16	◎	○
実施例36	28	10E14	◎	○
実施例37	34	10E15	○	○
実施例38	30	10E15	○	○
実施例39	34	10E14	◎	○
実施例40	33	10E15	○	○

[0091]
[Table 7]

（表２の続き）

実施例41	31	10E14	○	○
実施例42	31	10E15	○	○
実施例43	36	10E14	◎	○
実施例44	34	10E13	○	○
実施例45	31	10E14	○	○
実施例46	35	10E15	○	○
実施例47	32	10E15	◎	○
実施例48	28	10E16	○	○
実施例49	32	10E14	◎	○
実施例50	32	10E15	○	○
実施例51	34	10E14	◎	○
実施例52	33	10E14	○	○
実施例53	30	10E15	○	○
実施例54	32	10E14	○	○
実施例55	34	10E14	◎	○
実施例56	32	10E15	◎	○
実施例57	35	10E15	◎	○
実施例58	35	10E14	◎	○
実施例59	32	10E14	○	○
実施例60	33	10E15	◎	○

[0092]

[Table 8]

（表２の続き）

実施例61	33	10E16	◎	○
実施例62	34	10E14	○	○
実施例63	31	10E14	○	○
実施例64	34	10E16	◎	○
実施例65	32	10E15	○	○
実施例66	30	10E15	○	○
実施例67	33	10E15	◎	○
比較例1	49	10E6	○	△
比較例2	48	10E5	△	×
比較例3	52	10E6	○	△
比較例4	49	10E5	△	×
比較例5	48	10E6	△	×

The SEM photograph of this invention article and a comparison article manufactured in

Example 12 and the comparative example 3 is shown in drawing 1 and drawing 2. The magnification is 5000.

[0093]

[Effect of the Invention]The electromagnetic wave cover nature resin composition of this invention forms sea-island structure by at least two sorts of thermoplastics, and at least one sort of conductive fillers, and. By using a discontinuous discontinuous phase with the composition in which a conductive filler is made unevenly distributed, the outstanding molding workability can be given and the precision mold goods of which advanced surface smoothness is required can be obtained. Since a conductive filler is unevenly distributed with high density, excel in electromagnetic wave shielding performance and as a material corresponding to EMC (Electro-magnetic Compatibility), Generating of the unnecessary electromagnetic waves from a telecommunication apparatus system, a device, etc. is suppressed, Or the function which protects a telecommunication apparatus system, a device, etc. from the unnecessary electromagnetic waves which come from abroad can be exhibited, cases, such as telecommunication apparatus, can be made into the start, and it can use conveniently for the part of which the electromagnetic wave cover nature in a connector, an IC package, etc. is required.

[0094]The value of the volume resistivity of the electromagnetic wave cover nature resin composition of this invention, Since it is an insulating field, it has an advantage, like to the product part of which electromagnetic wave cover nature is required, and the product part of which insulation is required, it is also possible to incorporate the integrally molded product using the resin composition of this invention, and simplification of product manufacturing, reduction of a manufacturing cost, etc. can be aimed at by this.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]In an electromagnetic wave cover nature resin composition which contains at least two sorts of thermoplastics, and a conductive filler as the main ingredients, An electromagnetic wave cover nature resin composition which it has the sea-island structure which said resin composition has a value of volume resistivity more than 10^{11}omegacm, and said resin composition constituted from said at least two sorts of thermoplastics, and is characterized by making said conductive filler come to be unevenly distributed in said discontinuous phase.
[Claim 2]In an electromagnetic wave cover nature resin composition which contains at least two sorts of thermoplastics, a conductive filler, and a compatibilizer as the main ingredients, An electromagnetic wave cover nature resin composition which it has the sea-island structure which said resin composition has a value of volume resistivity more than 10^{11}omegacm, and said resin composition constituted from said at least two sorts of thermoplastics, and is characterized by making said conductive filler come to be unevenly distributed in said discontinuous phase.
[Claim 3]A compatibilizer An epoxy denaturation styrene styrene copolymer, an epoxy denaturation styrene-methylmethacrylate copolymer, An epoxy denaturation methyl methacrylate styrene ethylenic copolymer, An epoxy denaturation methyl methacrylate methyl methacrylate ethylenic copolymer, A styrene-methylmethacrylate copolymer, an epoxy denaturation methyl methacrylate methyl methacrylate copolymer, The electromagnetic wave cover nature resin composition according to claim 2 which is at least one sort chosen from a group which consists of an epoxy denaturation methyl methacrylate styrene copolymer and a maleic anhydride-vinyl system copolymer.
[Claim 4]Thermoplastics Polyethylene, polypropylene, polystyrene, polymethylmethacrylate, Acrylonitrile-butadiene-styrene copolymer, polyacetal, Polycarbonate, polyphenylene ether, modified polyphenylene ether, The electromagnetic wave cover nature resin composition

according to claim 1 or 2 which are polyamide, polyethylene terephthalate, polybutylene terephthalate, a polyphenylene sulfide, polyether sulphone, and resin chosen from a group which consists of polyether imides.

[Claim 5]The electromagnetic wave cover nature resin composition according to claim 1 or 2 whose amount of thermoplastics of a discontinuous phase to the two-component system thermoplastics total quantity is ten to 80 capacity %.

[Claim 6]The electromagnetic wave cover nature resin composition according to claim 1 or 2 whose amount of thermoplastics of a discontinuous phase to 3 component-system thermoplastics total quantity is five to 80 capacity %.

[Claim 7]The electromagnetic wave cover nature resin composition according to claim 1 or 2 whose conductive fillers are at least one sort of conductive fillers chosen from carbon black, black lead, carbon fiber, a metal powder, a metal fiber, metallic-oxide powder, and a group that consists of metallic-oxide textiles.

[Claim 8]The electromagnetic wave cover nature resin composition according to claim 1 or 2 powder, a globular shape, or whose aspect ratio shape of a conductive filler is ten or less fibrous and in which the mean particle diameter or mean fiber diameter is 0.001-100 micrometers.

[Claim 9]The electromagnetic wave cover nature resin composition according to claim 1 or 2 whose content of a conductive filler to the total quantity of thermoplastics and a conductive filler is one to 50 capacity %.

[Claim 10]A cast which carries out the fabricating operation of the electromagnetic wave cover nature resin composition according to any one of claims 1 to 9.

[Translation done.]